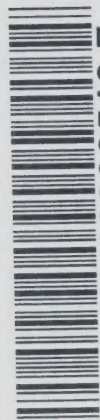


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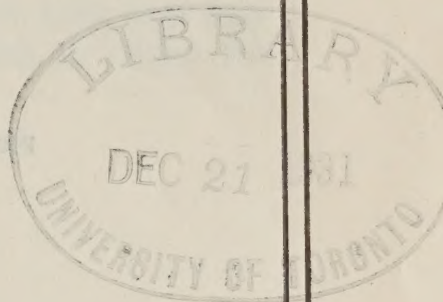


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# DIRECTIONS FOR COLLECTING AND PRESERVING INSECTS

By J. H. McDUNNOUGH, Ph.D.,  
Chief, Division of Systematic Entomology

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THE ENTOMOLOGICAL BRANCH

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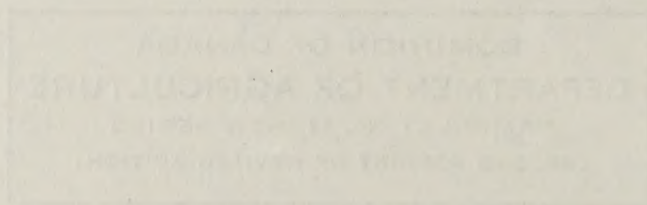
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DIRECTIONS FOR COLLECTING

AND

PRESERVING INSECTS

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1931





# Directions for Collecting and Preserving Insects

By J. H. McDUNNOUGH, Ph.D.,  
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## INTRODUCTION

The object of this circular is to indicate as concisely as possible some of the most essential features in connection with the collecting of insects. It is intended largely as a first aid to those anxious to learn the elementary principles of insect collecting in order that they may profitably occupy moments which might otherwise hang heavy on their hands. It further aims to arouse an interest for *intelligent* collecting among those who may be called by their vocations to the more inaccessible portions of the country; insect material from such localities is always of the utmost scientific value, but unfortunately this value may be greatly reduced by improper methods of collecting; insects, in the main, are very delicate creatures and unless the greatest care be observed in both collecting and packing for shipment an otherwise valuable collection may be rendered practically worthless not only from the aesthetic but also from the scientific standpoint.

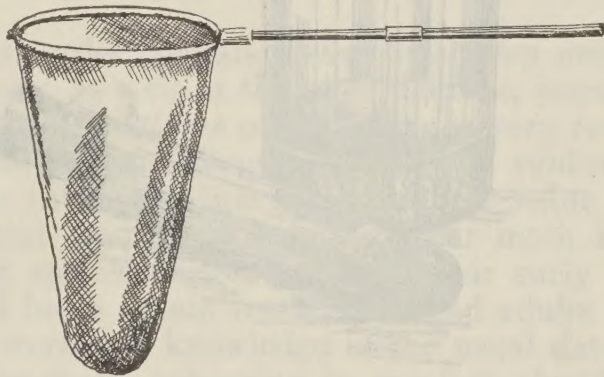


Fig. 1.—An insect net.

## THE COLLECTING OUTFIT

The size and nature of the outfit is more or less dependent on the length of time to be spent in collecting, the possible limitation of the collecting to one or two groups or orders of insects and, above all, on the amount of space available among the other travelling equipment for collecting utensils. Absolutely essential are (1) a net, (2) several poison bottles of various sizes, (3) a pair of entomological forceps, and (4) receptacles in which to pack and ship the insects when killed.

*Net.*—A net (Fig. 1) may be obtained from any reliable dealer in entomological supplies for a moderate sum; it consists of a handle, generally two or three-jointed, a ring of heavy wire or steel, 12 to 14 inches in diameter, also jointed for the sake of compactness in packing, and fitting by various devices to the end of the handle, and a bag of fine white tarlatan, bruxelle or leno, about two feet deep. The last mentioned material should be soaked in water over



night before being made up in order to remove the stiffness. Ingenious persons often manufacture their own nets but in general the purchased ones prove more satisfactory. On an extended trip it is wise to carry at least two complete nets and several extra bags in view of possible accidents.

For collecting smaller insects such as moths, flies, and mosquitoes, a net with short handle and a ring diameter of about 6 inches is very handy; the bag for this net must consist of very fine-meshed material or even silk, as the minute insects escape through the meshes of an ordinary net.

For "sweeping" through weeds, grass or underbrush, it is advisable to remove the ordinary bag and substitute one made of heavier material such as coarse muslin or cotton. The bag used in collecting aquatic insects is shorter and more open-meshed; mesh of about one-eighth inch is to be recommended. Some collectors prefer a cheap wire sieve, such as is used in any kitchen, this being attached to a long rod.



Fig. 2.—Poison bottles (A) test-tube size, (B) large size.

*Poison Bottle.*—The poison bottle may vary in size from a small test-tube to a pint (or even quart) preserving jar. The average collector will need for a season's work about half a dozen small bottles (large test tube size), (Fig 2, A), several larger ones with wide mouth capable of holding a good-sized butterfly (Fig. 2, B), and possibly one or two pint preserving jars which are useful as storage poison bottles, especially if night collecting be contemplated. The bottles should be tightly corked, each cork projecting at least half an inch above the lip of the bottle so that it may be readily grasped and removed when bottling a captured insect.

The poison used is almost invariably potassium cyanide or sodium cyanide which, being very deadly, should be handled with great care. The bottles should all bear the label POISON. The methods of preparing the poison bottle vary; some collectors, after covering the bottom of the bottle with cyanide broken into lumps the size of a small bean, pour into the bottle a liquid formed by mixing plaster of paris with water until a consistency of thick paint is obtained. This should cover the poison to the depth of about half an inch, the bottle being left uncorked for 12 to 15 hours to allow the plaster of paris to harden. A wad of



cotton should then be lightly fastened to the hard upper surface to prevent injury to the specimens, and the bottle is ready for use. Many use slightly moistened sawdust to cover the cyanide, pouring merely a thin layer of plaster of paris over the sawdust to keep it in place. The use of plaster of paris may be totally obviated by pressing down the sawdust with a disk of thick cardboard or thin sheet cork having a diameter slightly larger than the inside diameter of the bottle; unless the bottle is subjected to very severe shaking the contents are held in place quite satisfactorily and the method has the additional advantage that, when the cyanide has lost its efficiency, the contents of the bottle may be removed and fresh cyanide substituted without difficulty.

The test-tube variety of poison bottle may be very quickly prepared by dropping into the tube a few small lumps of cyanide, adding a pinch of slightly moistened sawdust to hasten the reaction, and wedging the whole firmly in place with a wad of cotton. A convenient holder for six or more test tubes is made by stitching to a piece of cloth small pockets, each the width of a single tube but slightly less in height; when the tubes are placed in the individual pockets the whole cloth may be rolled up and carried about freely without danger of breakage.

### METHODS OF COLLECTING

Insects may be collected almost anywhere and at any time, but a knowledge of the habits of the various groups is essential in order to secure the best results. Owing to the diversity of methods employed in collecting in the various orders it has seemed advisable to treat the main orders separately, noting in each case certain of the principal methods.

*Lepidoptera*.—This order consists of the butterflies and moths and contains many of the most showy, as well as the most delicate, insects in existence. The fine scaling comprising the vestiture of the wings is very readily rubbed and the utmost care is necessary in handling specimens; a rubbed specimen not only constitutes an eyesore in a collection but is of less value scientifically than a perfect one. In general the life of a butterfly or moth is short, and after a few days on the wing specimens lose some of their early beauty. The object of the collector should be to obtain freshly emerged adults and this can only be done by careful field work and knowledge of the usual dates of appearance.

Butterflies are day-fliers, appearing in greatest abundance on warm, sunshiny days, between the hours of 10 a.m. and 2 p.m.; they may be captured with the net around flowers or often at moist spots on the ground. It seldom pays to chase them any distance, they should rather be stalked; a dead specimen pinned to a bush will often serve as a decoy to others of its kind.

When a lucky stroke of the net has secured a specimen, a downward turn of the wrist closes the net by bringing the bag against the ring; if a corner of the net be now held up the insect will generally fly into it and may be secured by carefully inserting the poison bottle into the net and placing it over the specimen. The cork may be placed over the mouth of the bottle from the outside of the net for a moment, until the flutterings cease, when the bottle can be withdrawn without danger of the insect escaping. Experienced collectors usually stun a butterfly while in the net by a sharp pinch on the underside of the body at the base of the legs, removing it in a quiescent state to the poison bottle. It is most inadvisable to place a fluttering butterfly or any other living insect in a poison bottle which already contains specimens; as soon as quieted a specimen should be removed to a second poison bottle, the so-called store bottle, where it may remain for several hours, if necessary, until the collector has time to examine his catch.



At dusk strong-scented flowers such as lilacs, honey-suckle, petunias, etc., prove very attractive to hawk moths and early flying noctuids; as these are mostly large specimens and very strong fliers a pint fruit jar will be necessary as poison bottle.

The majority of moths are night-fliers and many are attracted to light; a favourably situated electric light will on warm, dark evenings draw numerous species which may be captured in the net. Adjacent tree trunks and posts, as well as the ground in the vicinity, should also be searched for specimens. Where electric lights are not available powerful gasolene or acetylene lanterns placed in front of white sheets on the edge of woods or on verandahs of country houses often produce excellent results. Moths should never be pinched like butterflies while in the net; they must be removed solely by means of the cyanide bottle and later transferred to the store bottle.

A second method of capturing moths is by "sugaring." The sugaring mixture is composed of molasses, thinned with stale beer (in "dry" territory denatured alcohol may be used) to which, just before using, a few drops of banana extract or other fruit extract is added. The mixture is applied before dusk to rough-barked trees situated on the edge of a wood or at the sides of a road leading through a wood. The strip of sugar on each tree should be not more than 3 inches wide and one foot long, and if the same trees be sugared night after night the attractive power of the mixture generally increases. After dark the sugared trees are visited with a dark lantern or electric flash-lamp and the assembled moths bottled. On favourable nights an amazing number of moths will be found on each patch of sugar and it is necessary to work swiftly; for this reason at least three or four medium-sized poison bottles and one large store bottle are necessary. Several trips may be made in the course of an evening, allowing intervals during which the moths can again congregate; on this account a circular route is preferable, if possible. Late summer and fall are the most favourable times of the year for sugaring; on moonlight nights neither of the above methods will be found very efficacious.

Many moths may be found resting on tree trunks in the day time and, if approached warily, may be captured by placing a suitable sized poison bottle over them. Small moths may be flushed on dull days out of grass or bushes, the test-tube type of poison bottle being very handy for removing such specimens from the net.

The very large silk-worm moths (Saturniids) are too large to be placed in an ordinary sized poison bottle. They may be speedily killed by injecting ammonia, oxalic acid or benzine into the body by means of a hypodermic syringe or a sharp pointed pen, the insect being held firmly at the base of the wings to prevent fluttering.

The methods of packing Lepidoptera for storage and shipment are discussed under another heading. Generally speaking, butterflies, hawk moths and the large silk-worm moths should be "papered," other moths should be pinned, and the very small moths (Microlepidoptera) should be placed between thin sheets of cellucotton or absorbent cotton glazed on both sides such as can be purchased in any dry goods store. Other methods being unavailable, the last mentioned one may be safely used for all species.

*Diptera*.—This large order embraces the two-winged flies, including the gnats, mosquitoes, crane-flies, bee-flies, robber-flies, flower-flies, house-flies, etc. For the collection of these insects special methods are necessary. In general, the collector of all orders should carry at least two bottles for the reception of Diptera, one for the fragile species and one for the more robust ones. If especially interested in the collection of flies, at least six vials should be carried, in order to keep the several groups more or less separated. The most convenient



assortment of bottles is four to six 4 inches by  $\frac{5}{8}$  inch and two or three 5 inches by 1 inch, the smaller specimens being placed in the small bottles, care being taken to keep such things as mosquitoes, midges, bee-flies, etc., separate, while crane flies may be placed in one of the larger vials. It must be remembered that care is necessary in order to secure perfect specimens and it should be a rule not to place more than about twenty fragile specimens in a bottle; with bee-flies which lose their hair very readily not more than half a dozen should be in a bottle. The insects should be carefully placed in a store box so that the wings will remain flat, only a few specimens of similar weight being placed in a layer. If large and small specimens are stored in the same box, the large ones must always be at the bottom; if they are mixed the fragile specimens are sure to be ruined. The most suitable net for the collection of diptera is what is commercially known as the "Midget Net" which is about 8 inches across, the net being much finer than those used for larger insects. *Diptera must never be placed in a vial with specimens of other orders* as they become crushed or covered with scales and thereby lose much of their value.

The successful collection of any order of insects develops into an art and the more adept the collector becomes the more valuable the collection becomes, and the greater the joy in collecting. It is necessary to study, therefore, more or less, the habits of the various families. A very large number of species may be found on flowers. In such places one finds syrphid-flies, soldier-flies, bee-flies, tachinids, sarcophagids, etc. Sweet-scented bloom is the most productive. Large, single blossoms, while conspicuous, seldom attract flies, those with small, clustered bloom being most attractive. By far the largest number of flies never visit bloom and must be searched for in various localities. Some are found almost entirely sunning on leaves, while others, especially the beautiful little long-legged-flies, are found largely upon mud along the banks of streams, shores of ponds, etc.; others frequent leaves in moist places, where they sport about in the sun. A few species lack wings; some of these may be found crawling about on the snow, others about fungi and rotting wood. Certain species will be found almost exclusively about the entrance to ant-hills. Some species crawl about on the surface of the water while others dance in swarms scarcely above the surface. Sweeping will yield many small species but does not, unless carefully managed, produce perfect specimens. A cotton bag is best for this purpose. As a great many Diptera resemble bees so closely it is very often difficult to distinguish them in natural surroundings.

The mounting of Diptera often requires great care. Wherever possible the ordinary type of insect pin should be used. A No. 00 pin can be used for remarkably small specimens if they are pinned while fresh. Large insects should have large pins. For specimens too small to be pinned it is preferable to use liquid shellac or seccotine, the pin being twisted about so that there is a complete ring of the fluid on the pin at about three-fourths the distance from the bottom. The side of the thorax is then touched with the pin and the specimen appears as though actually pinned. This method is also of great value in mounting small, dried specimens which lose their colour if relaxed. If card points are used the legs of the insect should be towards the pin, the left side of the insect resting upon the shellac at the tip of the point.

*Hymenoptera*.—The remarks about collecting and caring for Diptera apply to the bees, wasps, ants, saw-flies, etc., but most of these insects are rather robust or strong in structure and consequently need slightly less care. However, as some families often eject honey or nectar while dying, care should be taken not to place really large and small insects together.

As many wild bees visit only one or a few species of flowers, the collector should be prepared to isolate species taken upon a single variety of bloom.



This is accomplished by frequent transfers to the store box. If the species of flowering plant is not known a sprig should be taken, numbered, so that it may later be determined. The bloom is best preserved in alcohol or by pressing and drying. Hymenoptera are found much in the same surroundings as Diptera: sand-pits also yield large numbers. Very small Hymenoptera should be mounted as outlined under the Diptera.

*Coleoptera and Hemiptera.*—The first-named order contains the beetles, the latter the true bugs; these are mostly hard-bodied species and more tenacious of life in the poison bottle than species of other orders. For this reason *it is never advisable to place beetles or bugs in the same poison bottles with moths or flies*, although, being less delicate themselves, they suffer no great harm when placed with members of their own kind.

The ordinary net is less used when collecting in these two orders although in spring many a good specimen may be taken on the wing. Sweeping is very productive, and beating trees and bushes into an expanded umbrella held beneath them is to be recommended. Many species may be picked off flower heads or leaves and numerous others, notably the ground beetles, are attracted to light and may be found crawling on the road beneath electric lights. Wood-boring species are found beneath bark or around piles of freshly cut wood; the carrion beetles frequent the bodies of dead animals and other decaying animal matter. Very excellent collecting both in living and dead forms is often to be had among the drift wood and other refuse along the shore of a lake, and old boards and stones, when overturned, prove to be the hiding place of numbers of species. For collecting aquatic forms a dip or sieve net is necessary, the spring and fall of the year being the most productive seasons. Many small species may be secured by sifting dried leaves, moss and decaying rubbish over a white cloth. Owing to the fact that numerous species of both these orders hibernate in the adult state sifting may be profitably engaged in during the entire winter when the temperature is above freezing; the material may be collected in large paper bags and brought home to be worked over at leisure.

Some collectors kill their specimens of beetles and bugs by placing them in a vial of 70-80 per cent alcohol, shipping the insects in the same vial when it is full. Such a method has its advantage possibly in economy of labour, but the specimens are quite apt to lose their brilliancy of colour as the alcohol tends more or less to dissolve the pigment cells of the wing cases and body. Plant lice (*Aphididæ*) and their allies, which belong to the Hemiptera Homoptera, should, however, *always* be killed and preserved in alcohol in order that the bodies may retain their shape and be suitable for microscopic mounts. A label in pencil giving the food plant should be inserted in the vial. Packing in dry sawdust is quite satisfactory for the larger species, but the small ones should either be placed between glazed cotton wool, as mentioned above, or in small vials and pill boxes between wads of cotton.

*Orthoptera.*—The grasshoppers, crickets and roaches, constituting the major portion of this order, are more or less hard-bodied, especially when mature, and should be treated in much the same manner as beetles and bugs. The day-lovers, such as locusts and grasshoppers, may be captured either with the net or by sweeping in meadows; the adult forms have fully developed wings and care should be taken to secure specimens of these as well as of the nymphs, in which the wings are more or less undeveloped. The night-lovers, notably crickets, katydids, etc., may often be traced by their song and their hiding place revealed by the electric flash lamp.

*Neuropteroid Insects.*—Broadly speaking, neuropteroid insects include a number of groups of rather delicate-bodied insects with transparent or semi-



transparent wings. Several of these groups (stone-flies, caddis-flies) are aquatic in the early stages and the adults may be collected in the vicinity of bodies of water, often in countless numbers. They either fly by night and are attracted to light or may be stirred up or swept from bushes in the day time; their flight is generally feeble. The bodies are delicate and liable to become crushed; if the specimens therefore are not pinned while in a fresh condition but placed between layers of cotton wool, care must be exercised to avoid undue pressure and consequent distortion of the bodies.

Dragon-flies and damsel-flies, which are also aquatic in the early stages and constitute the order Odonata, are less delicate and may advantageously be papered for transportation. Rapid drying of these insects when in papers is recommended in order to preserve as fully as possible the delicate colour of the bodies.

*Ephemeridae*. (May Flies).—These delicate-winged insects, which are aquatic in their early stages, may often be found swarming in countless numbers in the late afternoon or early evening over or in the vicinity of water (lakes, streams, brooks). They are unique among insects in that they undergo a final moult in their winged condition (after emerging from the nymphal stage in water) before becoming mature. The subimagos, as they are termed, are often easier to obtain than the adults; they sit on the underside of leaves or on stones and buildings in the neighbourhood of their breeding places; they are recognizable by their less transparent (often blackish) wings, the shorter fore-legs of the male and the presence of a fringe of minute hairs along the edge of the wing. The subimago stage lasts from a few minutes to several days (generally about 12-15 hours); it is advisable, in order to secure the adults, to confine the subimago in jars lined with slightly moist blotting paper where they may undergo the final moult. Subimagos alone, without the associated adults, are worthless from a taxonomic point of view.

Where feasible, May-flies should be pinned as soon as possible after removal from the poison bottle; in the case of the larger species it is well to support the body on a thin strip of cardboard attached to the pin. They may also be packed between layers of cotton wool and for structural studies a certain number of specimens should be placed in a vial of 70 per cent alcohol and numbered to correspond to the pinned series.

*Animal Parasites*.—These insects belong to several orders but the method of collecting is the same in all cases. Bird lice (Mallophaga) may be secured by shaking freshly killed birds over, or laying them upon, white paper or a white sheet or by examining the nests of birds from which the young have just departed. Small nests may be stored in paper bags. Fleas (Siphonaptera) and lice are obtained by combing out or shaking freshly slain mammals or their skins either over white paper or, as fleas are very active, over a basin of water.

All material secured should be placed in small vials of 70-80 per cent alcohol, and data regarding host, etc., written in lead pencil on a piece of paper and placed inside.

Several other groups or orders of insects, consisting of minute species of which it is necessary to make microscopic mounts, should be preserved in alcohol rather than in a dry state. Besides the aphids, already mentioned under Hemiptera, might be mentioned the Collembola and Thysanura, the most primitive of insects commonly called spring-tails and bristle-tails; these are found under stones or decayed leaves and moss, preferably in damp places, some of the species occurring even on snow (snow fleas) or pools of water in countless numbers. The Thysanoptera or Thrips, minute insects found in the heads of flowers and grasses, must also be treated in the same manner.



## PRESERVING AND SHIPPING ENTOMOLOGICAL SPECIMENS

For preserving specimens for future shipment a very satisfactory method, especially for those unaccustomed to handling and pinning insects, is to cut a number of pieces of cellucotton or glazed absorbent cotton to fit snugly into a small wooden box; a small cigar box is quite serviceable and easily obtained. Placing one of the sheets of cotton on the bottom of the box, a portion of the day's catch may be emptied on it from the poison bottle. These insects may then be arranged with the forceps in parallel rows, care being taken to avoid over-lapping and also to see that the specimens on any one layer are fairly equal as regards size; a large clumsy beetle placed with some delicate midges or mosquitoes will often cause damage when the box is shaken. A label giving date, locality and name of collector should be placed with the insects. When the first layer of cotton is covered with insects, a second sheet is laid over the specimens, the ends of the layer being pressed gently down. This operation is repeated until the box is full when a little flake naphthalene may be sprinkled over the top layer to keep away museum pests, and the box closed and put aside for future examination. In using this method of storing it is inadvisable to make the top sheet of one layer the bottom sheet of the next higher one, as this will cause trouble when specimens are eventually moved from the box.

For certain groups of insects other methods of packing are much in vogue. The larger and clumsier beetles may be packed in tins between layers of fine sawdust. It is, however, essential that the sawdust be *absolutely dry* and that the tins be kept as free from moisture as possible as otherwise mould will form on the specimens. Very minute insects other than moths may be quite satisfactorily packed in small vials or pill boxes between wads of cotton, data regarding capture being written on a small piece of paper placed within the receptacle.

Day butterflies, dragon-flies and the large heavy-bodied moths should be "papered." So-called "papers" of various sizes may be made at one's leisure from moderately thick unglazed paper, cut and folded as shown in the accompanying diagram (Fig. 3, A). When papering specimens choose an envelope of

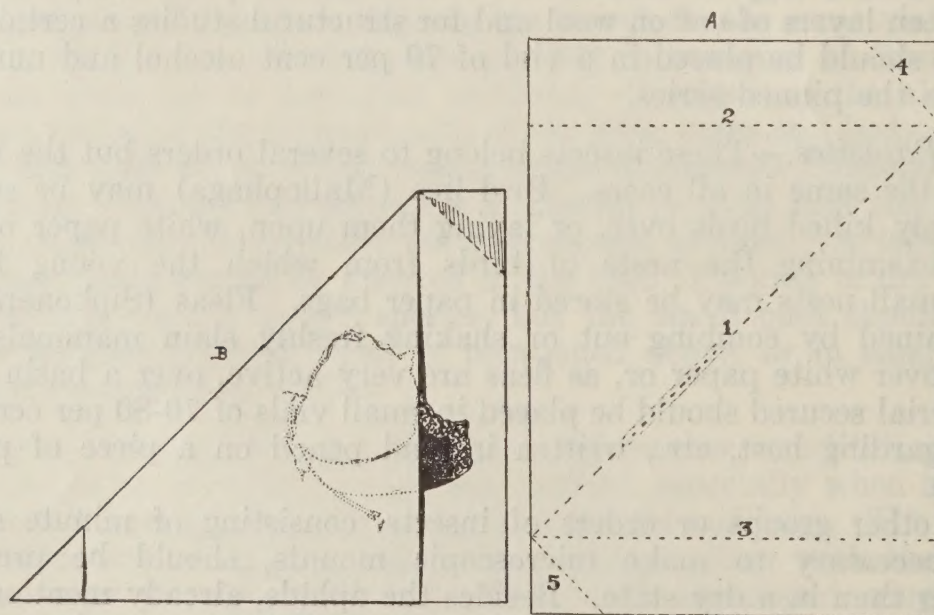


Fig. 3.—Paper envelope for lepidoptera, with method of folding; first fold along 1, second fold along 2, etc.

suitable size, grasp the insect underneath near the base of the wings—*never at the tip of the wings nor on the upper side*, in order to avoid injury to the delicate scaling—and place the body of the insect in the groove formed by partially opening the envelope (Fig. 3, B); when closed gently the wings should meet



above the head and the underside of the specimen be exposed. Data regarding capture should be written on the corner of each envelope. No more than one specimen should be placed in an envelope and *never* should a specimen with its wings *unfolded* be papered; if the wings, as frequently happens, cannot readily be brought into the desired position, the specimen should be laid between cotton. The habit of certain collectors in indiscriminately placing numerous specimens in one envelope, often merely a trimmed postal envelope, is to be deprecated; it only results in rubbed specimens of little value.

Papered specimens may be placed for shipment in cigar boxes or small tins. They should be tightly packed, care, however, being taken to avoid undue pressure on the specimens, *especially when moist*, as the bodies become flattened and unsightly; cotton placed over the top before closing the lid will prevent undue shaking.

*Pinning Specimens.*—If economy in space is no object and the collector has the time at his disposal better results are obtained in most groups, notably moths, wasps, flies, etc., if the specimens are pinned while fresh. Entomological pins of various sizes may be obtained from any dealer in entomological supplies. Black pins are preferable to white as they largely prevent the formation of verdigris; the most serviceable sizes are Nos. 0 to 3, inclusive. To pin specimens properly requires considerable practice. In the first place, the pin must be no thicker than necessary to support the insect properly; the forcing of a large pin through a small insect frequently ruins it. In moths (Fig. 4, A) the pin is inserted vertically through the centre of the thorax between the bases of the forewings, the specimen being held lightly between thumb and forefinger; at least one-quarter of the pin should project above the thorax. Bees, flies, etc., are also pinned through the thorax a little to one side of the central lines, and beetles (Fig. 4, B) through the right wing case near the base. Collectors unused to

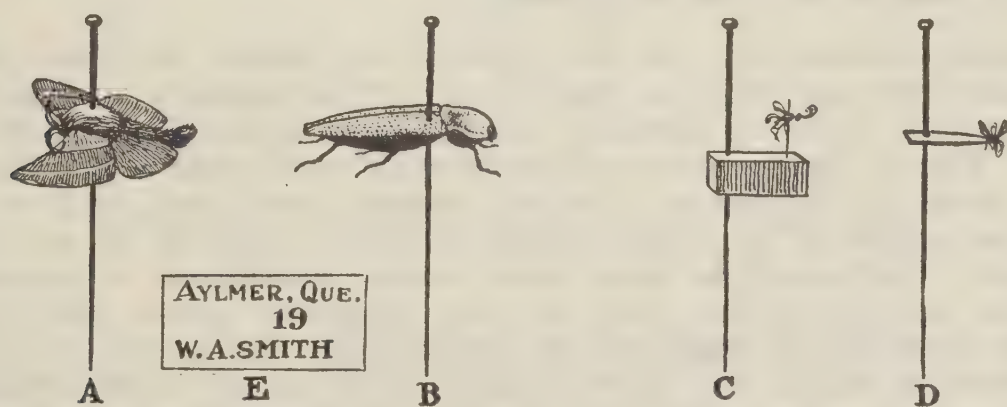


Fig 4.—Methods of pinning insects:—(A) a moth, (B) a beetle, (C) double mount, (D) cardboard point, (E) locality label.

pinning material should not attempt it in the field as they are apt to cause more damage to the specimens by doing so than if they had employed one of the simpler methods.

In packing such specimens for shipment they should be securely pinned as closely together as possible in a cigar box, the bottom of which is lined with  $\frac{1}{4}$ -inch sheet of compressed cork; date and locality of capture may be either fastened to each pin or written on the inside of the lid of the box.

When shipping boxes of insects, packed according to any of the above methods, by mail or express, the box or boxes should be first wrapped in paper and securely tied. The package should then be either imbedded in a generous layer of excelsior or sea-weed and the whole tightly wrapped in heavy paper



(Fig. 5) or, better still, packed into a larger box or carton with plenty of excelsior. The latter method is essential when shipping pinned specimens, which are more liable to damage through rough handling than papered specimens. In any case, however, an ounce of prevention is better than a pound of cure, and while over-care in packing will never harm the specimens, careless packing may often result in the partial or total destruction of much valuable material.

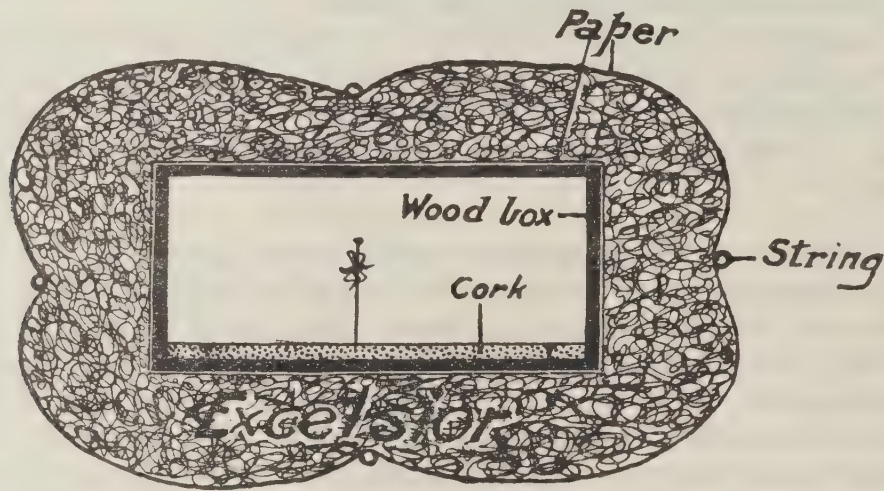


Fig 5.—Cross section of a package ready for shipment.

#### PERMANENT PRESERVATION OF INSECTS

The following section contains a few general hints on the permanent preservation of insects, which may prove of value to school teachers or to those desirous of forming a private collection.

*Relaxing.*—Insects dry out very rapidly and become hard and brittle so that if stored for any length of time by any of the methods mentioned in the previous section it will be necessary to relax them before they can be further handled. This is done by placing them on moist sand under a bell glass or in a large closed tin, the bottom of which contains moist cork, peat or felt; in twenty-four hours—or less if the insects are small—they are as soft as when first caught. Care should be taken when relaxing Lepidoptera to prevent drops of moisture forming on the wings as they frequently cause unsightly spots especially when blue or green colours predominate. In the case of specimens packed between cotton, the whole layer may be placed in the relaxing box, the top layer of cotton being first removed. A drop or two of carbolic acid will prevent the formation of mould. Papered specimens may be quite satisfactorily relaxed by placing the envelopes between damp cloths.

For a permanent collection all larger insects are pinned according to the directions already given. Small Lepidoptera, Diptera and Hymenoptera are frequently mounted on fine pieces of pointed wire called micro, or minuten-pins; as these pins are only one-third the length of an ordinary insect pin the method involves the use of a double mount, the micro-pin being inserted into a small rectangular piece of cork raised to the required height on an ordinary stout insect pin (Fig. 4, C). Other small insects may be affixed by means of glue or shellac to the apex of a small triangular piece of cardboard in such a manner that the head of the insect faces the right. An ordinary insect pin is then pinned through the base of the cardboard (Fig. 4, D).

*Spreading.*—Specimens of insects other than Lepidoptera, Odonata and a few Neuropteroid insects, if already pinned in the field, do not require relaxing,



but are ready for the cabinet after having been properly labelled. Specimens of these orders, however, must have the wings expanded before being placed in the permanent cabinet. Spreading boards of various sizes are, therefore, necessary and may either be purchased from any entomological dealer or made at home from pine, or some other soft wood. They consist of two strips of wood, generally 12 or 18 inches long, attached at each end to braces, leaving a space of varying width between them to contain the body of the insect; the illustration (Fig. 6) shows a portion of such board. A piece of thin cork or stout tape is glued immediately beneath the body groove and a thicker piece of cork fastened to the base of the board directly under this same groove. The height of the spreading board should be such that when the body of the insect lies in the groove and the base of the wings is level with the side pieces, the point of the pin should just enter the lower piece of cork and still leave one-quarter of its length projecting above the insect. To accommodate all sizes of insects the body grooves should vary in width from one-sixteenth to three-quarter inches. In spreading an insect care must be taken that the pin is perpendicular to the main axis of the body and that the insect's body is pressed just so far into the

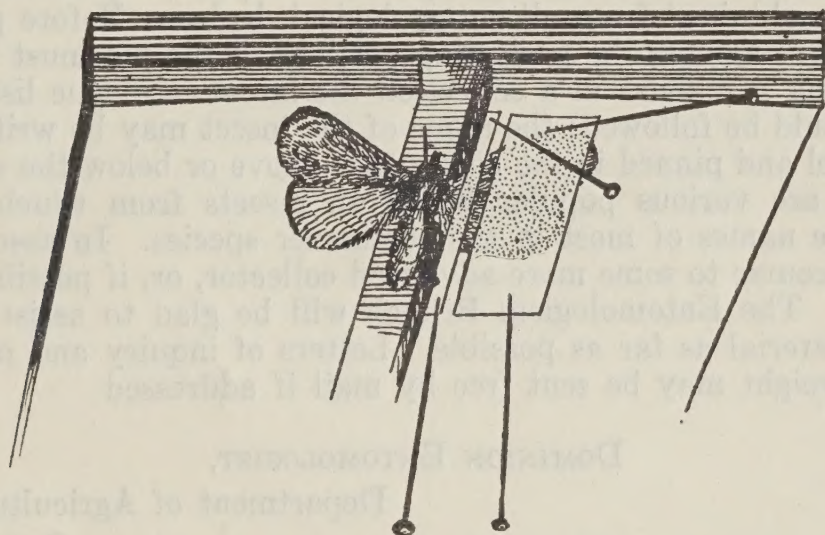


Fig. 6.—Portion of a spreading board showing mounted moth.

groove of the board as to allow the wings to lie perfectly flat on the wood. To draw the wings into the position shown in the illustration a spreading needle is necessary, which may easily be made by forcing the blunt end of a very fine insect pin (No. 00) into a match. Strips of tracing cloth or rough semi-transparent paper are used to keep the wings in the desired position; the inner strip should be narrow and be pinned as near the base of the wing as possible; the outer one should cover the remaining area of both wings. Before attempting to draw the wings into position the upper end of the narrow strip should be firmly pinned in place, then holding the lower end in the fingers so that it presses the wings gently down on the spreading board, the spreading needle is inserted behind a vein and each wing drawn carefully to the desired height; by tightening the strip and pinning it firmly down it will be found that the wings remain in position. Specimens should be left a week or ten days on the spreading board or in any case until thoroughly dry. After removal a small label (Fig. 4, E) bearing date of capture, locality and name of collector should be placed on the pin beneath each specimen. The labels should always be as small and neat as possible, the month being in Roman numerals. In Lepidoptera and the Neuropteroid insects the label is placed parallel to the wing expanse; in



other orders parallel to the body, the locality name being in the right hand corner. The importance of this labelling cannot be too greatly emphasized; a collection accurately labelled and containing such further data regarding food plants, etc., as is known to the collector, is of undoubted scientific value; an unlabelled collection is the bane of the scientific investigator.

*Insect Cases.*—Insect collections are generally contained in glass-topped cases about 18 by 20 by 2½ inches, the bottom being lined with sheet or compressed cork covered with white paper. As light will gradually fade the colours of the specimens, these cases should be kept in a dark cabinet. A less expensive method for beginners is the use of pasteboard or wooden boxes about 9 by 12 inches provided with tight-fitting lids. Unless, however, the lids fit securely specimens preserved in such boxes are frequently destroyed by museum pests such as clothes moths or carpet beetles; a little flake naphthalene in the corner of the box is a good preventive against such pests. For school or exhibition purposes the so-called Riker mount is much in demand. This consists of a shallow cardboard tray, lightly and evenly packed with white cotton; the specimen being placed on top of the cotton, a tightly fitting glass cover is carefully pressed down and fastened into place with pins or gummed tape. Riker mounts may be obtained from all entomological dealers. Before placing pinned specimens in such mounts the projecting portions of the pin must be clipped off.

In arranging specimens in a collection the latest catalogue list of the group in question should be followed; the name of the insect may be written or printed on a small label and pinned in the case either above or below the series of specimens. There are various popular books on insects from which the beginner may obtain the names of most of the commoner species. In cases of doubt he should have recourse to some more advanced collector, or, if possible, the curator of a museum. The Entomological Branch will be glad to assist in the determination of material as far as possible. Letters of inquiry and packages up to 12 ounces in weight may be sent free by mail if addressed

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